Blåvinge (Fred. Olsen Seawind, Hafslund and Ørsted) propsals for NVF 2023 updates, Reference 22/01071									
Item	Part	Paragraph	Chapter	Sub-Chapter	Clause	Page	NVF 2023 text	Alternative Proposal	Comment
1	IV	11	11.4				N/A	Grid Forming shall high levelly mean: The capability of a power park to stably operate connected to an AC power system and supplying power under normal, disturbed and emergency states without having to rely on services from Synchronous Generators. Comment: As such requirements and technology for RES are still evolving. Detailed definitions and functional requirements will for the time being be assessed on a case by case base.	At least some definition on the new term "grid forming" is regarded as necessary for having a basis for the new requirements mentioned below.
2	IV	14	14.1	14.1.3	14.1.3.1	175	The system administrator can require wider frequency bands than that specified in Table 14-5, if it is considered necessary for the system operations. TABELL 14-5: KRAV TIL TÅLEGRENSER OG VARIGHET FOR FREKVENSVARIASJONER FOR KRAFTPARK Frekvensområde – Varighet 47,5-49,0 Hz – 30 minutter 49,0-51,0 Hz – Ubegrenset 51,0-51,5 Hz – 30 minutter 51,5-52,5 Hz – 30 minutter	The system administrator can require wider frequency bands than that specified in Table 14-5 exceeding 51,5 Hz temporarily , if it is proven to be necessary for the system operations. For a needs assessment of the ability of wider frequency bands, there must be sufficient information to show that this is socially rational. Chapter 2.1 summarizes the general principles that form the basis for the system administrator's assessments. Specifically for this requirement, the system operator's decision depends on how exposed the grid area is to separate operations, what use of synthetic insufficiency provides, the alternative cost of other measures and technical maturity. TABELL 14-5: KRAV TIL TÅLEGRENSER OG VARIGHET FOR FREKVENSVARIASJONER FOR KRAFTPARK Frekvensområde – Varighet 47,5-49,0 Hz – 30 minutter 49,0-51,0 Hz – Ubegrenset 51,0-51,5 Hz – 30 minutter 51,5-52,5 Hz – 30 minutter	Such a change / requierement exceeding e.g. NC RfG needs to be well justified. At this stage it is not obvious why this may be required especially as there is no proposal to aligne with / revise Clause 18.1.3.1. (frequency band requirements for HVDC Systems)
3	IV	14	14.1	14.1.4		175	The power parks shall be able to operate without restrictions at a rate of change of frequency (ROCOF) $\Delta f/\Delta t$ = ± 1.5 Hz/sec. measured over Δt = 1 sec. Production units shall not unnecessarily limit the ability to operate in the event of major quick frequency changes.	Frequency changes up to a rate of change of frequency (ROCOF) $\Delta f/\Delta t$ = ± 1.5 Hz/sec. measured over Δt = 1 sec must not lead to tripping of the power park. Production units shall not unnecessarily limit the ability to operate in the event of major quick frequency changes.	Proposal to improve language for making the requirement more clear. "Without restrictions" may be understood in many different ways. In our view the essence of the requirement is : Frequency changes up to this rate of change shall not lead to tripping of a power park. Same as for conventional generation, power parks might respond to fast frequency changes with some transient active power changes.
4	IV	14	14.2			176	N/A	Requirements below are addressing minimal power park performances. It is fully acceptable that power parks can fulfill such requirements also with other control system implementations than purely relying on power park controllers (e.g. but not limited to fulfilling the voltage control requirements by a combination of park controller and unit controls)	Additional text proposed for having the requirements set up in a technology neutral way. Generally requierements should be focused on the power park performance.
5	IV	14	14.3			179	At a frequency step that on stationary basis gives 10% active power response	The power parks shall be able to provide an active power response at the PCC to frequency changs as follows: At a frequency step that on stationary basis gives 10% active power response	Proposal for an editorial improvement. It should be please cleary stated, that it is the power park that needs to fulfil this requirement.

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Item	Part	Paragraph	Chapter	Sub-Chapter	Clause	Page	NVF 2023 text	Alternative Proposal	Comment
6	IV	14	14.6	14.6.2	14.6.2.1	186	Power parks of types C and D shall be able to provide a fast fault current contribution if this is required by the system administrator. The fault current contribution is a supplemental contribution to possible reactive production/consumption before faults occur and should be given continuously when the voltage deviation is greater than a threshold, ΔU_1 > 0.1 pu. The relationship between the voltage deviation from the threshold and the maximum fault current contribution must be adjustable by a factor, K=2-8. This is shown in Figure 14-12. Unless otherwise determined by the system administrator, K=4. The fault current contribution DIq depends on the voltage deviation and the set K-factor as follows: $\Delta I_q = -K * \Delta U_2$ where $\Delta U_2 = \Delta U - \Delta U_1$ Active power shall not be adjusted lower unnecessary to supply reactive fault current. The system administrator can also demand that the power park can supply asymmetric (1-phase or 2-phase) fault current.	Power parks of types C and D shall be able to provide fast fault current contribution if this is required by the system operator. The fast fault current contribution shall be provided in a continuously controlled manner and by injecting an additional positive sequence reactive current ΔI_q if the absolute positive sequence voltage deviation $\|\Delta U\|$ is greater than the threshold ΔU1 = 0,1 p.u, where ΔU is the difference between the positive sequence voltage compared and the 60 s floating average positive sequence voltage. The provision shall be continued for at least 1500 milliseconds or till the Power Park is tripped by protections, whichever is sooner. Transition back to the implemented reactive power control scheme in accordance with Clause 14.2.4 shall be stable and smooth with no greater reactive power step than 5 Mvar or 5% of Qmax whichever is the lowest of the two. Fast fault current contribution is not required for voltages above the limits determined in Clause 14.1.2 and for voltages below 0,15 p.u. The minimal ΔI_q to be injected while respecting the limits $\Delta I_{q,max}$, $\Delta I_{q,min}$ and the maximum continuous voltage limits in all three phases depends on the voltage deviation and a factor K as follows: $\Delta I_q = -K * \Delta U_2$ where $\Delta U_2 = \Delta U - \Delta U_1$ When providing a fast fault current the provision of an additional positive sequence reactive fault current shall get priority against active power injection. For meeting the requirements above and the Fault Ride Through requirements stated in Clause 14.6.1 a temporary reduction in active power injection is generally allowed but active power shall not be reduced more than necessary for stable operation under fault conditions. Active power control schemes and Power Park specific settings to manage active power injection during faults and post fault clearing shall be agreed with the system operator.The system administrator can also demand that the power park can supply asymmetric (1-phase or 2-phase) fault current. In case of a fault a Power Park shall be generally capable to inject a total positive sequence reactive current up to its rated current (1 p.u.) and not more. Depending on the pre-fault reactive power provision in accordance with Clause 14.2.4 limits for $\Delta I_{q,max}$ and $\Delta I_{q,min}$ can be applied accordingly to respect the power park rating.	Proposal fo providing more clarity on - type of fault current - pre-fault voltage - fault current duration - maximum total current - post fault transition - relation between active and reactive current provision
7	IV	14	14.6	14.6.4	14.6.4.1	187	Power parks of type C and D shall have functionality for grid-forming properties if required by the system administrator. In such a case, the functioning of the control function must be reviewed and approved in the individual case.	Power parks of type C and D shall have functionality for grid-forming properties if required by the system administrator. In such a case, the functioning of the control function must be reviewed and approved in the individual case. Furthermore the power park is not requested to comply with Clause 14.6.2 and 14.6.3.	If grid forming controls would be requested, such controls will determine the fault current provision and the post fault active power recovery.
8	IV	15				193	In addition to the requirements in this chapter, HVDC-connected power parks shall meet the requirements in Chapter 14, with the exception of 14.1 and 14.5.1. The requirements of this chapter include power parks, not the HVDC system that connects the park(s) to the regional or transmission grid, which is covered by Chapters 17 and 18. The definitions for PCC and POC are similar for AC-related power parks, illustrated in Figure 14-1. For HVDC-connected power parks, the POC will normally be the connection point to the HVDC system transformer by removing transformers (see Chapter 17) or on a busbar, if there are several outlets with other con-nections to the HVDC system.	In addition to the requirements in this chapter, HVDC-connected power parks shall meet the requirements in Chapter 14, with the exception of 14.1 and 14.5.1. The requirements of this chapter include power parks, not the HVDC system that connects the park(s) to the regional or transmission grid, which is covered by Chapters 17 and 18. The definitions for PCC and POC are similar for AC-related power parks, illustrated in Figure 14-1. For HVDC-connected power parks, the POC will normally be the connection point to the HVDC system trans-former by a) remote end transformers (see Chapter 17) or b) on a busbar, if there are several outlets with other connections to the HVDC system. In case b) power parks can get aggredated to power stations fulfilling the requierments jointly as a system (e.g. but not limited to active power controls, voltage control, reactive power capability, etc.)	Proposal for clarification aiming to avoid inefficient power park connection schemes and processes.

<table>
<tr><th colspan="10">Blåvinge (Fred. Olsen Seawind, Hafslund and Ørsted) propsals for NVF 2023 updates, Reference 22/01071</th></tr>
<tr><th>Item</th><th>Part</th><th>Paragraph</th><th>Chapter</th><th>Sub-Chapter</th><th>Clause</th><th>Page</th><th>NVF 2023 text</th><th>Alternative Proposal</th><th>Comment</th></tr>
<tr><td>9</td><td>IV</td><td>15</td><td>15.1.1</td><td></td><td></td><td>193</td><td>The system administrator can require broader frequency bands than that specified in Table 15-2 if it is considered necessary for the purpose of system operation.

TABELL 15-2: MINIMUM VARIGHET SOM DC-TILKNYTTEDE KRAFTPARKMODULER SKAL KU FRA 50 HZ.<table><tr><th>Frekvensområde</th><th>Varighet</th></tr><tr><td>47,0-47,5 Hz</td><td>20 sekunder</td></tr><tr><td>47,5-49 Hz</td><td>90 minutter</td></tr><tr><td>49,0-51,0 Hz</td><td>Ubegrenset</td></tr><tr><td>51,0-51,5 Hz</td><td>90 minutter</td></tr><tr><td>51,5-52,0 Hz</td><td>15 minutter</td></tr></table></td><td>N/A</td><td>it is not obvious why HVDC-connected Power Parks are just required to operate at up to 52 Hz for at least 15 minutes, while the Statnett proposal for 14.1.3.1 requests AC connected power parks to operate at 52,5 Hz for up to 30 Minutes. Maybe there is some further alignment necessary? Please also refer to Item 2 above.</td></tr>
<tr><td>10</td><td>IV</td><td>15</td><td>15.2</td><td>15.2.1</td><td>15.2.1.1</td><td>194</td><td>TABELL 15-5: GRENSER FOR REAKTIV YTELSE, INNENFOR HVILKE SYSTEMANSVARLIG SKAL FASTSETTE KRAV TIL HVDC TILKNYTTEDE KRAFTPARKER. REFERERT PCC.<table><tr><th></th><th>Reaktiv effekt referert P_{maks}</th><th>Effektfaktor $(\frac{P_{maks}}{S_n})$</th></tr><tr><td>Kapasitiv ytelse</td><td>$\frac{Q_{kap,maks}}{P_{maks}} = 0,75 - 0,33$</td><td>$\cos\varphi_{kap} = 0,8 - 0,95$</td></tr><tr><td>Induktiv ytelse</td><td>$\frac{Q_{ind,maks}}{P_{maks}} = 0,75 - 0,33$</td><td>$\cos\varphi_{ind} = 0,8 - 0,95$</td></tr></table></td><td>$Q_{kap,maks} / P_{maks}$ = 0,41 - 0,14
cos φ_{kap} = 0,925 - 0,99

$Q_{ind,maks} / P_{maks}$ = 0,41 - 0,14
cos φ_{kap} = 0,925 - 0,99</td><td>HVDC Transmission Systems based on state of art VSC techology do not demand such large amounts of reactiv power from connected power parks for transferring the power and keeping the voltage at POC stable within the required limits. To our knowledge no further justification is available that such requirement is socially rational.

Therefore we propose to relax the requirement. The proposal is also based on the established German connection standard VDE AR-N 4131:2018 for HVDC connected power parks.</td></tr>
<tr><td>11</td><td>V</td><td>18</td><td>18.1</td><td>18.1.3</td><td>18.1.3.1</td><td>211</td><td>TABELL 18-5: KRAV TIL TÅLEGRENSER OG VARIGHET FOR FREKVENSVARIASJONER FOR HV<table><tr><th>Frekvensområde</th><th>Varighet</th></tr><tr><td>47,0 Hz – 47,5 Hz</td><td>60 sekunder</td></tr><tr><td>47,5 Hz – 49,0 Hz</td><td>90 minutter</td></tr><tr><td>49,0 Hz – 51,0 Hz</td><td>Ubegrenset</td></tr><tr><td>51,0 Hz – 51,5 Hz</td><td>90 minutter</td></tr><tr><td>51,5 Hz – 52,0 Hz</td><td>15 minutter</td></tr></table></td><td>N/A</td><td>It is not obvious why HVDC-Systems are just required to operate at up 52 Hz for at least 15 minutes, while the Statnett proposal for 14.1.3.1 requests AC connectec power parks to operate at 52,5 Hz for up to 30 Minutes. Maybe there is some further alignment necessary? Please also refer to Item 2 above.</td></tr>
<tr><td>12</td><td>V</td><td>18</td><td>18.2</td><td>18.2.6</td><td>18.2.6.1</td><td>214</td><td>HVDC systems shall have functionality for grid-forming properties if this is required by the system administrator. In such a case, the functioning of the control function must be reviewed and approved in the individual case.</td><td>HVDC systems shall have functionality for grid-forming properties if required by the system administrator. In such a case, the functioning of the control function must be reviewed and approved in the individual case. Furthermore the HVDC System is not requested to comply with Clause 18.4.2. and 18.4.3</td><td>If grid forming is requested, such controls will determine the fault current provision and the power fault active power recovery. Please also refer to Item 7 above.</td></tr>
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Item	Part	Paragraph	Chapter	Sub-Chapter	Clause	Page	NVF 2023 text	Alternative Proposal	Comment
13	V	18	18.4	18.4.2	18.4.2.1	220	HVDC Systems shall be able to provide a fast fault current contribution if this is required by the system administrator. The fault current contribution is a supplemental contribution to possible reactive production/consumption before faults occur and should be given continuously when the voltage deviation is greater than a threshold, $\Delta U_1 > 0.1$ pu. The relationship between the voltage deviation from the threshold and the maximum fault current contribution must be adjustable by a factor, K=2-8. This is shown in Figure 14-12. Unless otherwise determined by the system administrator, K=4. The fault current contribution DIq depends on the voltage deviation and the set K-factor as follows: $\Delta I_q = -K * \Delta U_2$ where $\Delta U_2 = \Delta U - \Delta U_1$ Active power shall not be adjusted lower unnecessary to supply reactive fault current. The system administrator can also demand that the power park can supply asymmetric (1-phase or 2-phase) fault current.	HVDC Systems shall be able to provide fast fault current contribution if this is required by the system operator. The fast fault current contribution shall be provided in a continuously controlled manner and by injecting an additional positive sequence reactive current ΔI_q if the absolute positive sequence voltage deviation $\|\Delta U\|$ is greater than the threshold $\Delta U1$ = 0,1 p.u, where ΔU is the difference between the positive sequence voltage compared and the 60 s floating average positive sequence voltage. The provision shall be continued for at least 1500 milliseconds or till the Power Park is tripped by protections, whichever is sooner. Transition back to the implemented reactive power control scheme in accordance with Clause 14.2.4 shall be stable and smooth with no greater reactive power step than 5 Mvar or 5% of Qmax whichever is the lowest of the two. Fast fault current contribution is not required for voltages above the limits determined in Clause 14.1.2 and for voltages below 0,15 p.u. The minimal ΔI_q to be injected while respecting the limits $\Delta I_{q,max}$, $\Delta I_{q,min}$ and the maximum continuous voltage limits in all three phases depends on the voltage deviation and a factor K as follows: $\Delta I_q = -K * \Delta U_2$ where $\Delta U_2 = \Delta U - \Delta U_1$ When providing a fast fault current the provision of an additional positive sequence reactive fault current shall get priority against active power injection. For meeting the requirements above and the Fault Ride Through requirements stated in Clause 14.6.1 a temporary reduction in active power injection is generally allowed but active power shall not be reduced more than necessary for stable operation under fault conditions. Active power control schemes and Power Park specific settings to manage active power injection during faults and post fault clearing shall be agreed with the system operator.The system administrator can also demand that the power park can supply asymmetric (1-phase or 2-phase) fault current. In case of a fault a Power Park shall be generally capable to inject a total positive sequence reactive current up to its rated current (1 p.u.) and not more. Depending on the pre-fault reactive power provision in accordance with Clause 14.2.4 limits for $\Delta I_{q,max}$ and $\Delta I_{q,min}$ can be applied accordingly to respect the power park rating.	Proposal fo providing more clarity on - type of fault current - pre-fault voltage - fault current duration - maximum total current - post fault transition - relation between active and reactive current provision